SEASONAL VARIATIONS OF AIRBORNE FUNGI ABOVE BANANA FIELDS IN QENA, UPPER EGYPT

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ABSTRACT - The "exposed plate" method was used to trap fungal spores from the atmosphere of Qena over a period of one year (January-December 1992). 78 species and 2 varieties belonging to 38 genera developed on plates of glucose and cellulose-Czapek's agar at 28°C. Counts of airborne fungi on glucose and cellulose agar plates showed seasonal trends with peaks in December and November 1992, respectively. Most common genera were *Acremonium, Alternaria, Aspergillus, Cladosporium, Cochliobolus, Curvularia, Fusarium, Gibberella, Memnoniella, Mycosphaerella, Myrothecium, Nectria, Penicillium* and *Setosphaeria*. Best counts of fungi were estimated during different months.

INTRODUCTION

Banana is very important crop at Qena because it is cultivated in large areas in upper Egypt. Several fungal diseases of plants and human beings are conveyed by air. Deterioration of stored materials and spoilage of foodstuffs is induced by growth of saprophytic fungi through aerial contamination. Numerous investigations have been carried out on airspora in many parts of the world. Recent investigations were conducted by Vittal & Krishnamoorthi 1981, 1988; Moubasher *et al.*, 1981, 1988; Mazen & Shaban, 1983; Lighthart, 1984; Banerjee *et al.*, 1987; Abdel-Hafez & El-Said, 1989; Abdel-Hafez *et al.*, 1990. The present work aims to study composition, number, frequency of occurrence and seasonal variations of fungi in the atmosphere of Qena (Upper Egypt).

MATERIAL AND METHODS

The "exposed plate" method was used to estimate airborne fungi from the atmosphere of banana fields at Qena, over a period of one year (January-December 1992). Ten plates (9 cm diam.) were used: 5 plates for each type of medium for each air sample. Glucose - and cellulose - Czapek's agar were used for isolation of glucophilic and cellulose-decomposing fungi, respectively. Rose bengal (1/30000) and chloramphenicol (0.05 mg/ml) were added as bacteriostatic agents (Smith & Dawson, 1944; Al-Doory, 1980). Plates were exposed at 10 a.m. every 15 days for one min., about 40 cm above banana level. Plates were incubated at 28°C for 7-10 days and developing colonies counted "colony forming units" and identified (purely morphological, based on

macro- and microscopic characteristics). Numbers were recorded monthly per 10 plates in 2 exposures of one min. each and calculated totally per 240 plates in 48 exposures of one min. each. Relative humidity and temperature values were recorded during the observation period.

RESULTS AND DISCUSSION

Average temperature of the atmosphere at Qena during January-December 1992 fluctuated between 10-13°C. Maximum record was in August and minimum in January. Relative humidity of the air ranged between 50-73% with the highest value obtained during January and the minimum in April (Fig. 1).

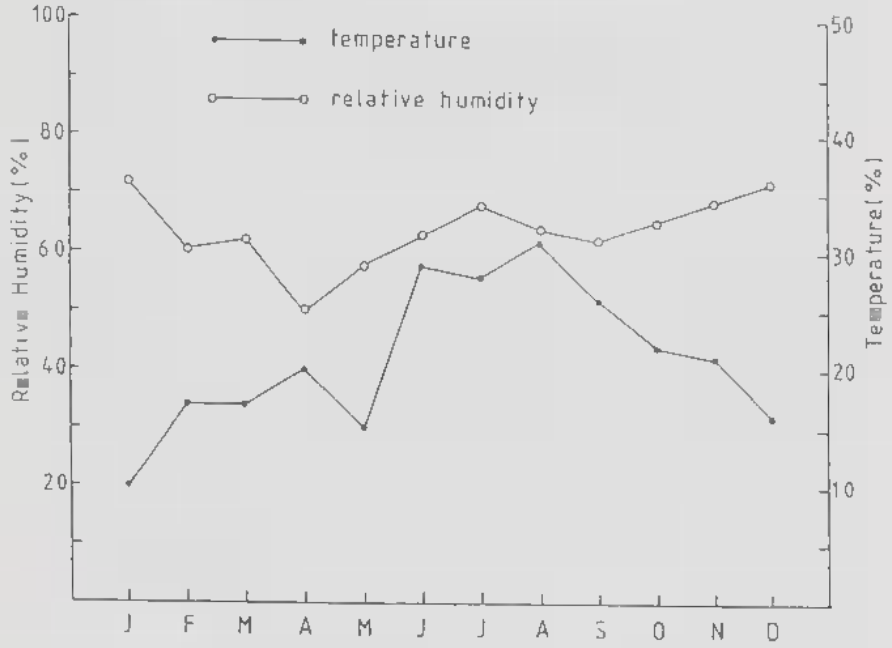

Fig. 1 - Monthly temperature and relative humidities of the air over banana plant during the periods January-December 1992.

Mesophiles recovered on glucose-Czapek's agar:

70 species and 1 species variety belonging to 32 genera were collected on 1% glucose-Czapek's agar at 28°C (Table 1). Total numbers of colonies developing the air of banana field on 240 plates of glucose were 2240. Monthly counts of colonies irregularly fluctuated with peaks in December (Fig. 2). Moubasher & Moustafa (1974) and Moubasher *et al.* (1981) found highest incidences of airborne fungi in Assiut and Qena Governorates in spring and autumn. However Moubasher *et al.* (1988) obtained peaks of fungal spores from Wadi Bir-El-Ain in September 1978 and October 1979. Also,

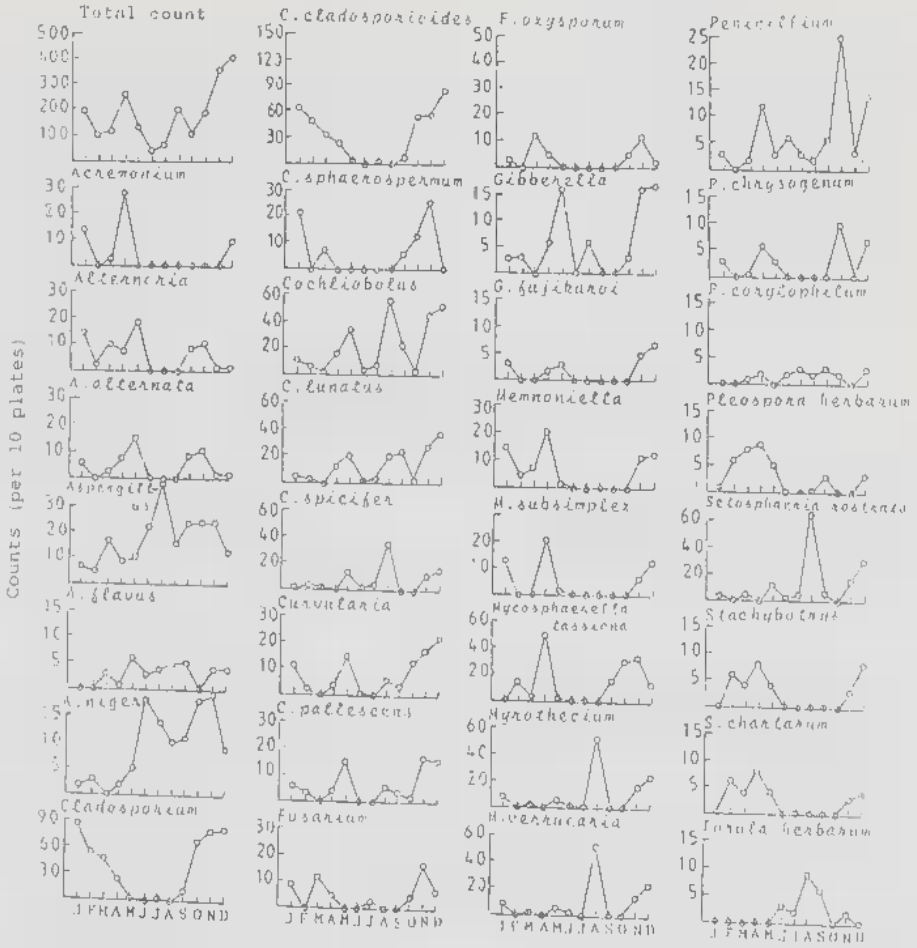

Fig. 2 - Monthly counts (per 10 plates) of common airborne fungi during january-December 1992 on glucose-Czapek's agar at 28°C.

Abdel-Hafez & El-Said (1989) and Abdel-Hafez *et al.* (1990) found that peaks of airborne fungi in the atmosphere of Wadi Qena over lentile fields were during March and October. In other areas of the world, peak numbers of airborne fungal species have been recorded at different times of the year. In New-Zealand, DiMenna (1955) observed peak numbers in summer, whereas in England, peaks occurred in summer and early autumn (Hudson, 1969; Pawsey and Heath, 1964). In India, Kumar and Gupta (1976) and Mishra and Kamal (1971) found the peak in winter.

Species of *Alternaria, Aspergillus, Cladosporium, Cochliobolus, Curvularia, Mycosphaerella, Penicillium* and *Setosphaeria* were frequently isolated. Their occurrence on plates of 1% glucose agar ranged between 91.7% (*Aspergillus*) to 54.2% (*Alternaria* and *Mycosphaerella*). Their contributions to total fungal counts varied from 20.5% (*Cladosporium*) to 2.9% (*Penicillium*). Counts of these genera irregularly fluc-

tuated giving peaks in May, July, January, August, December, April, October and August, respectively (Fig. 2). Most of the preceding genera were almost dominant on plates of 1% glucose agar in the atmosphere of different Governorates in Egypt (Abdel-Hafez & El-Said, 1989 and Abdel-Hafez *et al.*, 1990). Also from the atmosphere of Kuwait (Moustafa & Kamel, 1976), Saudi Arabia (Abdel-Hafez, 1984 and Ali *et al.*,

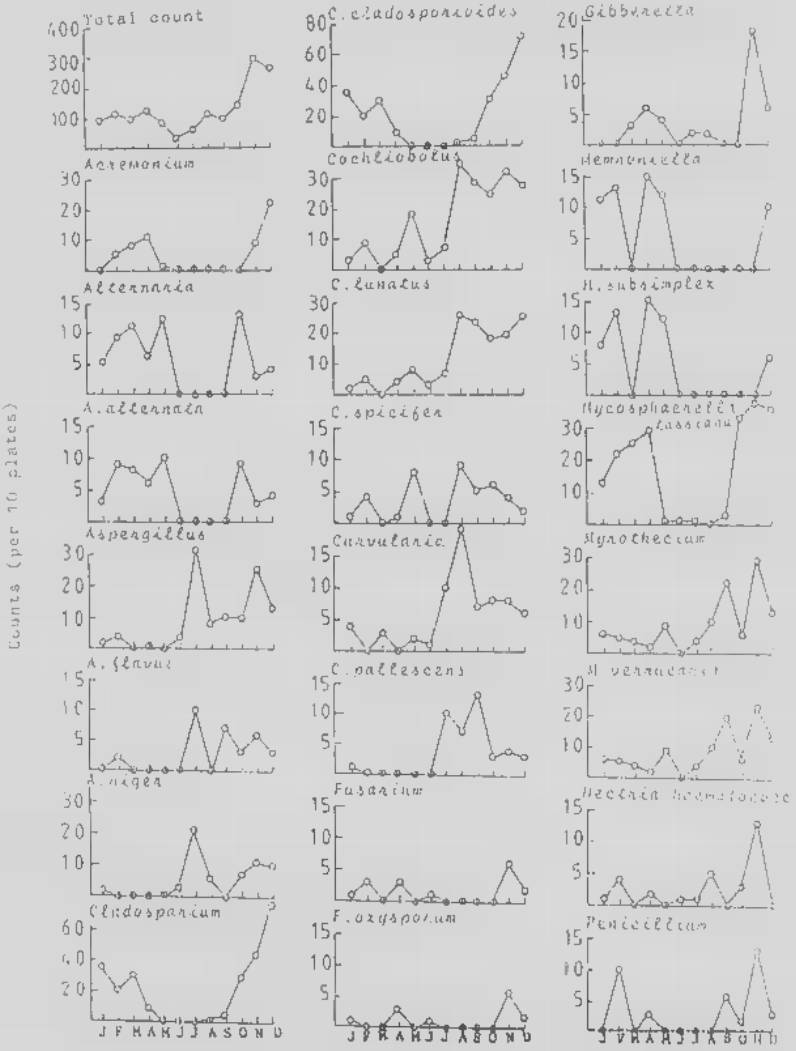

Fig. 3 - Monthly counts (per 10 plates) of common airborne fungi during January-December 1992 on cellulose-Czapek's agar at 28°C.

Table 1 - Total counts (TC calculated per 120 plates in 24 exposures of 1 min. each), number of cases of isolation (NCI, out of 24) and occurrence remarks (OR) of fungal genera and species recovered from the air on glucose- and cellulose-Czapek's agar at 28°C.

Genera and species	Glucose			Cellulose		
	TC	NCI	OR	TC	NCI	OR
Acremonium strictum W. Gams	55	6	M	56	10	M
Alternaria	80	13	H	63	13	H
A. alternata (Fries) Keissler	56	11	M	52	13	H
A. citri Ellis & Pierce	8	1	R			
A. raphani Grosves & Skolko	5	2	R			
A. tenuissima (Kunze : Pers.) Wiltshire	11	3	L	11	5	L
Aspergillus	213	22	H	108	15	H
A. candidus Link	2	1	R			
A. egyptiacus Moubasher & Moustafa	7	2	R			
A. flavus Link	35	12	H	31	9	M
A. fumigatus Fresenius	19	5	L			
A. niger Van Tieghem	117	20	H	60	12	H
A. ochraceus Wilhelm	6	4	L	7	5	L
A. sydowii (Bainier & Sartory) Thom & Church				9	3	L
A. terreus Thom	5	3	L	1	1	R
A. terreus var. *africanus* Fennell & Raper	9	4	L			
A. versicolor (Vuill.) Tiraboschi	13	5	L			
Botryotrichum atrogriseum Van Beyma	12	3	L	7	4	L
Chaetomium globosum Kunze				8	3	L
Cladosporium	460	17	H	247	16	H
C. cladosporioides (Fres.) de Vries	385	17	H	247	16	H
C. sphaerospermum Penzig	75		M			
Cochliobolus	270	19	H	189	19	H
C. bicolor Paul & Parbery	3	1	R			
C. hawaiiensis Alcorn, Trans.	7	1	R	8	1	R
C. intermedius Nelson	2	1	R	2	1	R
C. lunatus Nelson & Haasis	165	18	H	139	18	H
C. setariae (Ito & Kurib) Drechsler ex Dastur	1	1	R			
C. spicifer Nelson	92	15	H	40	12	H
Coleophoma cylindrospora (Desm.) Hohn.	3	1	R	19	3	L
Curvularia	96	15	H	68	14	H
C. clavata Jain	6	2				
C. lunata var. *aeria* (Batista, Lima & Vasconcebs) M.B. Ellis				19	5	L
C. oryzae Bugnicourt	3	1	R			
C. ovoidea (Hiroe & Watan.) Muntanola	13	2	R	15	5	L
C. pallescens Boedijn	73	13	H	41	11	M
C. prasadii R.L. & B.L. Mathur	1	1	R	3	2	R
Emericella nivea Wiley & Simmons	2	2	R			
Epicoccum nigrum Link	10	4	L			
Fusarium	58	9	M	16	8	M
F. nivale (Fr.) Ces.	5	1	R			
F. oxysporum Shelecht	38	8	M	13	7	M
F. poae (Peck) Wollenweber	3	1	R			

Table I (continued)

Genera and species	Glucose			Cellulose		
	TC	NCI	OR	TC	NCI	OR
F. semitectum Berk. & Rav.	6	2	R			
F. tricinctum (Corda) Sacc.	6	2	R	3	1	R
Gibberella	70	11	M	41	9	M
G. acuminata Wollenweber	14	3	L	7	2	R
G. avenacea R.J. Cook	6	1	R			
G. fujikuroi (Sawada) Ito	20	7	M	14	5	L
G. intricans Wollenweber	19	5	L			
G. zeae (Schwabe) Petch	11	4	L	20	4	L
Gilmaniella humicola Barrom				2	1	R
Humicola grisea Traaen				2	1	R
Macrophomina phaseolina (Tassi) Goid	3	2	R	7	1	R
Melanopsamma pomiformis (Pers. ex Fr.) Sacc.	3	1	R			
Memnoniella	76	11	M	61	10	M
M. echinata (Riv.) Galloway	15	3	L	7	2	R
M. subsimplex (Cooke) Deighton	56	9	M	54	10	M
Mycosphaerella tassiana (Albertini & Schweinitz) Ditmer ex Steudel	162	13	H	202	16	H
Myrothecium	112	10	M	110	16	H
M. roridum Tode ex Fr.	4	1	R	8	2	R
M. verrucaria (Alb. & Sch.) Dit.	108	10	M	102	16	H
Nectria haematococca Berkeley & Brown	16	4	L	30	5	L
Neurospora crassa Shear & Dodge				2	1	R
Paecilomyces terricola (Miller, Giddens & Foster) Onions & Barron	119	5	L	48	5	L
Penicillium	66	14	H	37	8	M
P. albidum Sopp	2	1	R			
P. chrysogenum Thom	23	7	M	13	4	L
P. citrinum Thom	6	2	R			
P. corylophilum Dierckx	18	8	M			
P. duclauxi Delacroix	2	1	R			
P. funiculosum Thom	7	4	L			
P. puberulum Bainier	8	2	R	24	5	L
Phoma	28	5	L	18	5	L
P. glomerata (Corda) Wollenweber & Hochapfel	26	4	L	14	5	L
P. humicola Gilman & Abbott	2	1	R	4	3	L
Pleospora herbarum (Fr.) Rabenh. ex Ces & de Not.	35	5	L			
Rhizopus stolonifer (Ehrenb.) Lind.	9	2	R			
Scolecobasidium variabile Barron & Busch	2	1	R			
Scopulariopsis	9	4	L	8	4	L
S. brevicaulis (Sacc.) Bainier	9	4	L			
S. brumptii Salvanet-Duval				8	4	L
Scytalidium lignicola Pesante				3	1	R
Setosphaeria rostrata Leonard	147	16	H	70	5	L
Stachybotrys	33	5	L	17	5	L
S. chartarum (Ehrenb. : Lindt) Hughes	29	5	L	17	5	L

Table I (continued)

Genera and species	Glucose			Cellulose		
	TC	NCI	OR	TC	NCI	OR
S. parvispora Hughes	4	1	R			
Talaromyces flavus (Klöcker) Stolk & Samson				4	1	R
Torula herbarum (Pers.) Link	23	5	L			
Trichoderma viride Pers. ex S.F. Gray	4	1	R	1	1	R
Trichothecium roseum (Pers.) Link : Gray	3	1	R			
Verticillium lateritium Berkeley	57	5	L	30	4	L
Gross total count	2240			1474		
Number of genera = 38	32			29		
Number of species = 78 + 2 var.	70 + 1 var.			46 + 1 var.		

Occurrence remarks: H = high occurrence, isolated from 12-24 cases (out of 24); M = moderate occurrence from 6-11 cases; L = low occurrence, from 3-5 cases; R = rare occurrence, from 1-2 cases.

1977), as well as from the air of different countries (DiMenna, 1955; Hudson, 1969; Pawsey & Heath, 1964; Mishra & Kamal,1971; Kumar & Gupta, 1976 and Banerjee *et al.*, 1987). *Alternaria alternata, Aspergillus flavus, A. niger, Cladosporium cladosporioides, C. sphaerospermum, Cochliobolus lunatus, C. spicifer, Curvularia pallescens, Mycosphaerella tassiana, Penicillium chrysogenum, P. corylophilum* and *Setosphaeria rostrata* proved to be most prevalent fungi in the atmosphere of banana field. They were encountered in 29.2-83.3% of total exposures matching 0.8-17.2% of total catch of airborne species. Peaks for these species were recorded at different periods of the year (Fig. 2). These fungi were also common in the atmosphere of different parts of the world as recorded and reported as cosmopolitan by several researchers. Remaining genera and species were isolated in low or rare frequencies of occurrence (Table 1).

Cellulose-decomposing fungi recovered on cellulose-Czapek's agar:

46 species and species variety which belong to 32 genera were collected on plates of cellulose-Czapek's agar at 28°C (Table 1). Total counts of these fungi on 240 plates were 1474 colonies. Monthly counts of fungi irregularly fluctuations giving peaks in November (Fig. 3). Previously Abdel-Hafez *et al.* (1990) had found peaks of airborne fungi over lentile field were in March. Also, El-Said (1990) obtained peaks of fungal spores from Wadi Abbadi in March. Results obtained on cellulose-Czapek's agar were basically similar to those on 1% glucose agar with most common genera being: *Alternaria* (2 species), *Aspergillus* (5), *Cladosporium* (1), *Cochliobolus* (4), *Curvularia* (3+1 variety), *Mycosphaerella* (1) and *Myrothecium* (2). Their occurrence on plates of 1% cellulose-Czapek's agar ranged between 79.2% (*Cochliobolus*) to 54.2% (*Alternaria*). Their contributions to total fungal counts varied from 16.8% (*Cladosporium*) to 4.3% (*Alternaria*). Respective counts irregularly fluctuated giving

maxima in October, July, December, August, August, November and November (Fig. 3). Most common observed species were: *Alternaria alternata, Aspergillus flavus, A. niger, Cladosporium cladosporioides, Cochliobolus lunatus, C. spicifer, Curvularia pallescens, Mycosphaerella tassiana* and *Myrothecium verrucaria*. They were encountered in 37.5-75% of numbers of exposures matching 2.1-16.8% of total fungi. Peaks for these species were recorded at different periods of the year (Fig. 3). Most of these genera and species were also common in the atmosphere of different Governorates in Egypt on 1% cellulose-Czapek's agar (Abdel-Sater, 1990; El-Said, 1990 and Abdel-Hafez *et al.*, 1990). The remaining genera and species developing on this medium were isolated in low or rare frequencies of occurrence (Table 1).

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